भारतीय मानक **IS 18286 : 2023**

Indian Standard

कृषि सिंचाई उपकरण — मैनुअल रूप से संचालित सर्विसेबल प्लास्टिक वाल्व — विशिष्टि

Agricultural Irrigation Equipment — Manually Operated Serviceable Plastics Valves — Specification

ICS 65.060.35

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Farm Irrigation and Drainage Systems Sectional Committee, FAD 17

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Farm Irrigation and Drainage Systems Sectional Committee had been approved by the Food and Agriculture Division Council.

Valves are used for starting or stopping flow, regulating or throttling flow, preventing back flow or relieving and regulating pressure in fluid handling applications. All kinds of valves should be anchored properly so as to minimize the turning movement imparted to the pipe during operation.

This standard has been formulated to standardize the manually operated plastic valves which are used in the micro-irrigation systems.

In the preparation of this standard, considerable assistance has been derived from ISO 24649 : 2022 'Agricultural irrigation equipment — Manually and hydraulically operated plastics valves'. The above ISO standard differs from the Indian Standard as the latter has been formulated in order to address the concerns of Indian micro-irrigation scenarios to improve the applicability and implementation of the standard. With concern to the above mentioned ISO standard the following major modifications have been made:

a) The scope of the Indian standard covers the specifications of only manually operated serviceable valves and does not cover hydraulically operated valves. It covers nominal diameter ranging from ¼" to 4".
b) Clause related to raw material specifications has been incorporated.
c) Closing torque requirements have been modified as per national micro-irrigation practices.
d) Testing conditions have been modified as well as test methods for additional parameters have been incorporated.

The composition of the Committee, responsible for the formulation of this standard is given in Annex F.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AGRICULTURAL IRRIGATION EQUIPMENT — MANUALLY OPERATED SERVICEABLE PLASTICS VALVES — SPECIFICATION

1 SCOPE

1.1 This Indian Standard specifies the general requirements and test methods for manually operated serviceable plastics valves intended for operation in agricultural irrigation systems. It is applicable to manually operated plastics valves of diameter nominal (DN) 8 (1/4") to diameter nominal 110 (4") including angle, globe, diaphragm and ball valves.

1.2 The valves are intended for installation in irrigation piping networks, using water at temperatures from 5 °C to 60 °C. Nominal pressures of the valves are as designated by the manufacturer.

2 REFERENCES

The standards listed in Annex A contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMINOLOGY

For the purposes of this document, the following terms and definitions apply.

3.1 Angle Valve — Valve with a cylindrical body in which the body ends are in planes perpendicular to each other and having a stem the axis of which is co-linear with the axis of one body end.

3.2 Ball Valve — Valve in which a ball can be turned to move its port, or ports, relative to the ports in the valve body, to control the flow of fluid.

3.3 Body — Main component of the valve which provides the fluid flow passageways and the body ends.

3.4 Closing Disc — Part of an obturator of any shape on which the disc face is formed and to which the disc facing ring, if used, is secured.

3.5 Closing Torque — Torque exerted over the closing operation to achieve full tightness of the valve at nominal pressure.

3.6 Dividing Wall — Integral part of the valve body which separates the inlet and outlet ports of a valve, and on which the valve seat is formed.

3.7 Diaphragm Valve — Valve in which a flexible diaphragm constitutes the closing and regulating mechanism to control the flow of fluid through the valve.

3.8 Disc Face — Smooth face of the obturator in a valve which makes contact with the valve seat when the valve is closed.

3.9 Disc Facing Ring — Ring of material different from the closing disc, secured to the disc and used to ensure water-tightness when a valve is closed.

3.10 Double Union Valve — Body or the sub assembly of the valve which is assembled to the end connections with two union nuts for not disturbing the pre-defined closing/opening torque.

3.11 Flow Co-Efficient (K_v Value) — Parameter defining the flow rates of valves describing the amount of water from 5 °C to 30 °C flowing through the valves at a pressure loss of 1 bar.

3.12 Globe Valve — Valve with a cylindrical body in which the axes of the body ends are co-linear and in which the axis of the stem is perpendicular to the axes of the body ends.

3.13 Nominal Pressure (PN) — Alphanumeric designation for reference purposes related to the mechanical strength of a valve.

NOTE — It usually corresponds to the service pressure in bar, with water at 20 °C, for which the valve is designed (1 bar = 0.1 MPa = 10^5 Pa = 1.02 Kg/cm^2; 1 MPa = 1 N/mm^2).

3.14 Nominal Size — Numerical designation used to refer to the size of a valve which is identical to the diameter of the pipe or pipes to which the valve is intended to be connected directly.

NOTE — A single number designation is adequate if the inlet and outlet ports are the same size.

3.15 Oblique Valve, Y-Globe Valve — Valve in which the axes of the body ends are co-linear and in which the axis of the stem is oblique to the axes of the body ends.

3.16 Obturator — Moving member in a valve that operates to close the valve and, where applicable, contains a washer or similar sealing device.

3.17 Opening Torque — Torque exerted initially to open the valve from fully closed or over the full opening operation at nominal pressure.

3.18 Seat — Part of the valve which provides the obturator seating surface.

NOTE — It can be either integral or a separate component.

3.19 Shell Test — Test intended to check the design strength of a valve body, under internal hydrostatic pressure.

3.20 Single Union Valve — Body or the sub assembly of the valve which is assembled to the end connections with a single union nut.

3.21 Single Piece (Body with Inbuilt end Connections) — Body moulded with inbuilt end connections and opening at top side for assembly of the parts and servicing.

3.22 Stem Shaft — Component of an obturator by which the actuating thread is formed and by which control of the closing component is affected.

3.23 Union Nut — Threaded ring which connects the body or the sub assembly of the valve to the end connections and also facilitates servicing of valve.

4 SAMPLING AND ACCEPTANCE REQUIREMENTS

4.1 Type-Tests

The sampling plan for type tests ensure that the test laboratory representative takes the sample of test specimens at random from a total of at least 100 valves. Also, it shall be ensured that the number of test specimens used for each test is in accordance with Table 1.

Table 1 Required Number of Test Specimens and Acceptance Number

(*Clause* 4.1 *and* 4.2)

Sl No. (1)	Clause (2)	Test (3)	Number of Test Specimens (4)	Acceptance Number (5)	Type Test (6)	Lot or Batch Acceptance Test (7)
i)	**5.4** to **5.8**	End Connections (Sockets, Threaded, Flanged, Spigot, Internal Grip, External Grip)	3	0	—	✓
ii)	**5.9**	Hand Wheel or Handle	3	0	—	✓
iii)	**5.10.2.2**	Hardness Test	3	0	✓	✓
iv)	**6**	Mechanical & Functional Tests (Technical characteristics)	2	0	✓	✓
v)	**6.2.1**	Closing torque	3	1	—	✓
vi)	**6.2.3**	Resistance to increased torque	3	0	✓	—
vii)	**6.3**	Pressure loss	2	0	✓	—
viii)	**6.4**	Resistance of valve and valve material to internal hydrostatic pressure	4	0	✓	—
ix)	**6.5**	Seat and stem sealing test	5	1	✓	—
x)	**6.6**	Valve performance at increased hydraulic pressure	2	0	—	✓
xi)	**6.7**	Endurance testing	2	0	✓	—
xii)	**D-1**	Moulded plastics material of valve body – Pressure test	2	0	✓	—
xiii)	**D-2**	Shell test	3	0	✓	—

If the number of defective specimens in the sample is equal to or less than the acceptance number given in Table 1, the lot shall be considered acceptable. If the number of defective specimens found in the test is greater than the acceptance number, the lot shall be rejected.

All parts of the valve shall be of good workmanship, whole and smooth, and shall contain no holes.

4.2 Acceptance Tests

When acceptance of manufacturing lots or of shipments of valves is required, the sampling shall be conducted as per in accordance with IS 4905.

Acceptance Tests shall be followed as per Table 1.

Test all specimens in the sample, selected at random in accordance with IS 2500 (Part 1) Table II-A, for 1 h, as specified in **6.5**.

The shipment or the lot complies with this standard if the number of defective specimens found in the test does not exceed the acceptance number according to IS 2500 (Part 1).

For other tests, the number of test specimens shall be selected at random from the sample in accordance with Table 1. Randomness of sampling shall be ensured as per IS 4905.

The shipment or the lot complies with this Standard if the number of defective specimens found in the other tests does not exceed the acceptance number specified in Table 1.

5 TECHNICAL CHARACTERISTICS

5.1 General

All valve components that come into contact with water shall not support the growth of algae and bacteria, nor be of metal which will corrode. Plastic parts of the valve that are exposed to sunlight shall be opaque and protected against UV degradation.

All parts of the valve shall be of good workmanship, whole and smooth, and shall contain no holes, air bubbles, flash, projections or any other defects that could impair performance or cause injury.

All parts of valves that are of the same size, type and model produced by the same manufacturer shall be interchangeable.

As agreed between the manufacturer and customer, manufacturer shall supply any available information on the resistance of the valve to corrosive attack by fertilizers and chemicals normally used in agriculture.

5.2 Material of Construction

The Material of construction shall include PVC (Polyvinyl chloride), PE (Polyethylene), PP (Polypropylene) and Elastomer like EPDM (Ethylene propylene diene monomer), PTFE (Polytetrafluoroethylene), NBR (Nitrile rubber), Poly Amide, POM (Polyoxymethylene), ABS (Acrylonitrile Butadiene Styrene).

NOTE — A report of conformance certificate may be obtained from the raw material and master batch manufacturer.

5.2.1 *PVC Raw Material*

The materials from which the valve body parts are produced shall consist essentially of polyvinyl chloride, to which may be added only those additives that are needed to facilitate the manufacture of sound and durable valves of good surface finish, mechanical strength and opacity. Titanium dioxide content shall not be less than 0.5 percent by mass as per method as per IS 12235 (Part 12).

5.2.1.1 *Composition*

The composition of PVC raw material used for the manufacturing of valves shall be in line with **6.1** and **6.2** of IS 4985.

5.2.2 *PE Raw Material*

PE Compound shall contain carbon black equivalent to a content of 2.5 percent ± 0.5 percent (m/m) and carbon black used in black master batch shall comply with the following requirements:

a) Toluene extract, not more than 0.1 percent (m/m) Annex B;
b) Maximum volatile matter, 9.0 percent (m/m) Annex C; and
c) Carbon black particle size should be less than 0.025µ.

5.2.2.1 *Antioxidant*

The percentage of antioxidant used shall not be more than 0.3 percent by mass of finished resin. The antioxidant used shall be physiologically harmless and shall be selected from the list given in IS 16621.

5.2.2.2 *Use of reprocessed and recycled PE material*

Clean, reprocessed material generated from a manufacture's own production and work testing of product according to this standard may be used if it is derived from the same raw material as used for relevant production. Reprocessed material obtained from external sources and recycled material shall not be used.

5.2.3 *PP Raw Material*

5.2.3.1 *Grade of raw material*

Material used as base resin/compound for manufacture of valve body parts shall be polypropylene copolymer. The material grading shall be given by the raw material supplier and in case of compound, by the compound manufacturer. The suggested list of grade of material for guidance of the manufacturer is as follows:

a) IS 10951-2-P-C-Q-A-C-F
b) IS 10951-2-P-C-Q-B-C-F
c) IS 10951-2-P-C-Q-C-C-F
d) IS 10951-2-P-C-N-A-C-F
e) IS 10951-2-P-C-N-B-C-F
f) IS 10951-2-P-C-N-C-C-F

5.2.3.2 *Poly propylene copolymer*

Poly propylene copolymer (PP) used for the manufacture of valves shall conform to the requirements of IS 10951 and IS 10910. MFR and density however, shall be as per **5.2.3.3** and **5.2.3.4**.

5.2.3.3 The specified base density shall be between 900 kg/m³ and 910 kg/m³ (both inclusive) when determined at 27 °C according to procedure prescribed in IS 13360 (Part 3/Sec 1).

5.2.3.4 The MFR of the material shall be ≥ 0.5 g/10 min when tested at 230 °C with nominal load of 2.16 kg as determined by method prescribed in IS 13360 (Part 4/Sec 1). The MFR of the material shall also be within ± 20 percent of the value declared by the manufacturer.

5.2.3.5 PP Compound shall contain carbon black equivalent to a content of 2.5 percent ± 0.5 percent (m/m) or Colour master batches. The Carbon Black or Colour master batch dispersion shall be uniform throughout the valve surface. Coloured compound shall be UV stabilized with minimum of 0.2 percent of a hindered amine light stabilizer (HALS). Alternatively, compound shall meet the requirement of **5.2.3.3** and **5.2.3.4**.

5.2.3.6 *Anti-oxidant*

The percentage of anti-oxidant used shall not be more than 0.3 percent by mass of finished resin. The antioxidant used shall be physiologically harmless and shall be selected from the list given in IS 16738.

5.2.3.7 *Reworked material*

The addition of not more than 10 percent of the manufacturer's own rework material from the manufacturer of valves is permissible. No other reworked or recycled material shall be used.

NOTE — A Test Report or confirmative certificate may be obtained from Raw material manufacturer.

5.3 Colour

Colour of Polyvinyl chloride (PVC), Polyethylene (PE), Polypropylene (PP) the compound should be either Grey or Black or as agreed between manufacturer and customer.

5.4 Connections to Pipeline

The connections of the valve to the pipeline shall be in accordance with Table 2. In valves with threaded ends, intended for direct connection to the pipeline, the threads shall be in accordance with **5.4.2**. However, other threads are allowed, provided that a suitable adaptor is supplied with each threaded connection such that it complies with **5.4.2**. In valves intended for connection to polyethylene pipe by mechanical jointing fittings, the fittings shall have spigot ends.

5.4.1 *Dimensions of End Connections*

Type of end connections — The type of ends connections of the valve made from various, polymer such as PP, PE, PVC etc shall be suitable to provide flexibility to connection to the pipe or fittings or the equipment as per user requirement. For example, PE and PP Valves may be manufactured with PVC Inserts/Adaptors to their end connections.

Table 2 Basic Dimensions

(*Clause* 5.4)

Sl No.	Material	Reference IS Standard
(1)	(2)	(3)
i)	Polypropylene (PP)	IS 15801
ii)	Polyethylene (PE)	IS 4984/IS 17425
iii)	Unplasticized polyvinyl chloride (PVC-U)	IS 4985/IS 7834 (Part 1)

The End Connection dimensions according to the type shall be as follows.

5.4.2 *Threaded*

5.4.2.1 Threaded end of the valves shall be complying with the requirements of IS 2643/IS 554.

5.4.2.2 Other forms of threads may be provided as agreed between the customer and manufacturer and declared in the catalogues and marked on the product.

5.4.3 *PVC Solvent Cement Welded Type End Connections (Plain Socket Connection)*

5.4.3.1 The plain socket connection size shall be designated by the nominal diameters of their plain connection. The inside diameters of the plain connection of the valve shall be corresponding to the outside diameters of the nominal pipes sizes to be connected as per IS 4985.

5.4.3.2 *Minimum thickness*

Thickness at any place in a plain socket connection shall not be less than 3 mm.

5.4.3.3 Plain socket connection length and diameter at mid-point of connection length shall be as specified in IS 7834 (Part 1).

5.4.3.4 The minimum plain connection length of any valve [*see* Fig. 1 of IS 7834 (Part 1)] shall be as given by the expression L = 0.5 D + 6 mm with a minimum of 12 mm. If manufacturer uses other dimensions of plain connection length as specified in the standard, it shall be declared in their technical catalogue.

where

L = plain connection length, and

D = nominal inside diameter of plain connection (corresponding to the outside diameter of the pipe covered in IS 4985).

5.4.3.5 The valve plain connection length is applicable to connection for pipes of any diameter under pressure. The minimum plain connection-length based on the formula in **5.4.3.4** for valves diameters ranging from 20 mm to 110 mm are given in Table 3.

5.4.3.6 The maximum and minimum dimensions of mean internal diameter at mid-point of plain connection length shall comply with those given in Table 3.

Table 3 Size of Sockets

(*Clause* 5.4.3.6)

Sl No.	Nominal Size (DN) (mm)	Minimum Plain Connection Length (mm)	Mean Internal Diameter at Midpoint of Plain Connection Length	
			Minimum (mm)	Maximum (mm)
(1)	(2)	(3)	(4)	(5)
i)	20	16	20.1	20.3
ii)	25	19	25.1	25.3
iii)	32	22	32.1	32.3
iv)	40	26	40.1	40.3
v)	50	31	50.1	50.3
vi)	63	38	63.1	63.3
vii)	75	44	75.1	75.3
viii)	90	51	90.1	90.3
ix)	110	61	110.1	110.4

5.4.3.7 *Out of roundness tolerances of plain connection inside diameter*

The maximum out-of-roundness tolerance (maximum diameter-minimum diameter) shall be:

a) Less than or equal to 0.007D, or
b) Equal to 0.2 mm (if 0.007D is less than 0.2 mm).

5.5 Flange Connection

If the valves are provided with flanged end, the dimension shall be as per Table 4.

5.5.1 If the flange connections are integral, slip-on, or welded, the dimensions of flanges shall be as specified in Table 4. If dimensions of flanges are other than specified in Table 4, the manufacturer shall declare the dimensions in their technical catalogue for reference to user.

5.5.2 The thickness of flange and number of bolts shall be considered as minimum; the manufacturer shall increase to improve the performance of valve.

5.5.3 The shape of bolt circle shall be circular/oval.

5.6 End Connection (Fusion Weld)

The end connections of PE/PP valves shall be suitable for socket fusion or for butt fusion as per Table under Fig. 2A of IS 15927 (Part 2). Dimensions of sockets suitable for socket fusion shall be designated by the diameters of their socket size. The inside diameters of the sockets shall correspond to the Outside diameters of the pipes sizes as per Table 3 of IS 4984.

The minimum thickness at any place measured along the socket length shall commensurate with pressure rating declared by the manufacturer and the thickness table specified in IS 4984. Socket length and diameter at midpoint of socket shall be as per Table 1 of IS 15927 (Part 1).

Butt fusion end connection shall be as per IS 8008 (Part 6). The outside diameter and the corresponding wall thickness of valves at the ends for weld shall comply with those given in IS 4984. The wall thickness of the valve shall be a minimum of PN06 or higher rated pipe material grade PE80 as per IS 4984.

The outside diameter shall be the average of two measurements taken at right angles. The wall thickness shall be measured with a ball ended micrometer or dial caliper. Resulting dimension shall be expressed to 0.10 mm.

Table 4 Flange Dimensions

(*Clauses* 5.5 *and* 5.5.1)

Sl No. (1)	**Nominal Size (DN)** (mm) (2)	**Overall Diameter of Flange** (mm) (3)	**Bolt Circle Diameter** (mm) (4)	**No. of Bolts** (5)	**Diameter of Bolt** (mm) (6)	**Minimum Thickness of Flange** (mm)[1] (7)
i)	25 (3/4")	101.6	73.0	4	12.7	4.8
ii)	32 (1")	114.3	82.6	4	12.7	4.8
iii)	40 (1 ¼")	120.7	87.3	4	12.7	6.4
iv)	50 (1 ½")	133.4	98.4	4	12.7	6.4
v)	63 (2")	152.4	114.3	4	15.9	7.9
vi)	75(2 ²/₂")	165.1	127.0	4	15.9	7.9
vii)	90 (3")	184.2	146.1	4	15.9	9.5
viii)	110 (4")	215.9	177.8	4	15.9	9.5

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[1] The thicknesses are specified for metal flanges only. For plastic flanges, the thickness shall be as per manufacturers' declaration to withstand the hydrostatic pressure tests as per **6.4** without any failure such as leakage caused by deflection, breakage, cracks etc.

5.7 Spigot End Dimensions Suitable for Butt Fusion and Compression Fittings (External Grip)

The dimensions of the spigot end connections of the valve shall be as per Table 1 of IS 15927 (Part 2).

5.8 End Connections Suitable for Internal Grip Fittings

Valves intended for connection to flexible PE pipes using internal grip fittings shall have barbed end and compression nut. The barbed end dimension shall be such that bore of the pipe doesn't increase by more than 15 percent of its original diameter at 27 °C when fitted.

5.9 Hand Wheel or Handle

The hand wheel or handle shall be free from sharp projections, burrs or other defects that could cause injury. The hand wheel or handle shall be securely connected to the valve stem and shall be replaceable.

5.10 Specific Construction Requirements for Globe, Oblique and Angle Valves

5.10.1 *Threaded Valve Stems or Spindles*

The threads of the valve stems or spindles shall be as designed by the manufacturer, provided they are self-locking.

The valve stem shall be of sufficient length to permit full closure of the valve when the hand wheel or handle is mounted on the stem and the disc facing ring is removed.

5.10.2 *Disc Facing Ring*

5.10.2.1 *General*

The disc facing ring, if used, shall remain securely attached to the disc when in operation, but shall be removable for replacement without requiring removal of the valve from the system-with or without the closing disc.

When the disc facing ring is of elastomeric material, the material shall meet the requirements given in **5.10.2.2** to **5.10.2.4.**

5.10.2.2 *Hardness*

The hardness test for the disc facing ring in shall be done in accordance with IS 3400 (Part 2) using methods N or M, depending on the disc facing ring shape. The hardness of the disc facing ring shall be 80 Shore A ± 5 or as specified by the manufacturer.

5.10.2.3 *Compression set*

The compression set for the disc facing ring in shall be done in accordance with IS 3400 (Part 10) for 24 hours at 70 °C. The compression set after compression shall not exceed 20 percent.

5.10.2.4 *Ageing*

Repeat the hardness test (**5.10.2.2**) after keeping the disc facing ring at 70 °C for 16 hours, in accordance with IS 3400 (Part 4) (accelerated ageing in oxygen). The change in hardness due to ageing shall be in the range of − 5 to + 8 Shore A.

5.11 Specific Construction Requirements for Ball Valves

5.11.1 The stem shall be provided with sealing means to ensure tightness. The sealing means shall be of elastomeric or other material of suitable mechanical properties and chemical resistance.

5.11.2 If the sealing means is of O-ring shape, the hardness of the O-rings shall be determined using the test method specified in IS 3400 (Part 2) and shall be not more than 60 to 80 Shore A ± 5.The compression set of the O-ring material shall be determined using the test method given in IS 3400 (Part 10/Sec 1) (22 hours at 70 °C) and shall be not more than 20 percent.

5.12 Classification of the Valves

5.12.1 The Valves shall be classified by pressure rating (working Pressure) at 27 °C as given in Table 5.

5.12.2 The Valves shall be classified by Type of Construction as given in Table 6.

6 MECHANICAL AND FUNCTIONAL TESTS

6.1 General

Unless otherwise required, the tests shall be performed with water at a temperature of 27 °C ± 3 °C. The permissible deviation of the measuring device readings from the actual values of the measured quantities shall be in accordance with Table 7.

6.2 Operating Torque

6.2.1 *Closing Torque*

6.2.2 *Conditioning*

Before carrying out this test, open and close the valve ten times to ensure smooth operation.

6.2.2.1 The valve is connected to the test circuit as per Fig. 1 with the outlet orifice connected in horizontal to flow control valve D and inlet is connected to flow meter A on test panel.

6.2.2.2 Place a pressure gauge B after the flow meter A to record the nominal test pressure.

6.2.2.3 Assemble the test valve C properly keep it in fully open position and maintain the nominal test pressure.

Table 5 Classification of Valves Based on Working Pressure

(*Clause* 5.12.1)

Sl No. (1)	**Class of Valve** (2)	**Working Pressure** (3)
i)	Class – 1	0.4 MPa (4 Kg/cm²)
ii)	Class – 2	0.6 MPa (6 Kg/cm²)
iii)	Class – 3	1.0 MPa (10 Kg/cm²)
iv)	Class – 4	1.6 MPa (16 Kg/cm²)

Table 6 Classification of Valves Based on Type of Construction

(*Clause* 5.12.2)

Sl No. (1)	**Type of Valve** (2)	**Type of Construction** (3)
i)	Type – A	Double Union
ii)	Type – B	Single Union
iii)	Type – C	Single Piece (Serviceable)

Table 7 Accuracy of Measurement

(*Clause* 7)

Sl No. (1)	**Measured Quantity** (2)	**Allowable Deviation Perecnt** (3)
i)	Flow-rate	± 2
ii)	Pressure	± 2
iii)	Torque	± 2

6.2.2.4 Adjust the flow control valve D to achieve the nominal Test pressure at a minimum flow velocity of 0.1 m/s.

6.2.2.5 Connect the valve handle to the torque device and measuring instrument and apply a torque, increasing it gradually until the closing torque is reached. Complete the closing of the valve in accordance with the requirements specified in the table.

The torque required to change the valve position from fully open to fully closed at nominal pressure shall not exceed the closing torque according to Table 8.

6.2.3 *Resistance to Increased Torque*

The test shall be carried out by applying a torque equal to the closing torque (*see* Table 8) multiplied by three: for 1 min while closing the valve and for 1 min while opening the valve. The valve and its parts shall withstand the torque without suffering damage and without any part becoming loose or disengaged. After applying the increased torque, the valve shall pass the seat and packing tightness tests given under **6.5**.

6.3 Pressure Loss

The measured pressure drop shall not be more than 10 percent greater than the pressure drop declared by the manufacturer.

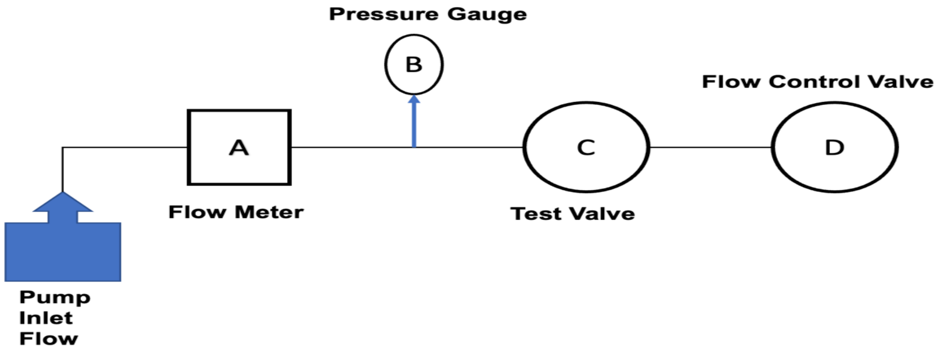


FIG. 1 FLOW DIAGRAM

Table 8 Closing Torque

(*Clause* 8)

Sl No.	Valve Nominal Size (DN) (mm)	Closing Torque (Nm)
(1)	(2)	(3)
i)	20 (1/2")	3
ii)	25 (3/4")	5
iii)	32 (1")	6
iv)	40 (1 ¼")	8
v)	50 (1 ½")	11
vi)	63 (2")	20
vii)	75 (2 ½")	28
viii)	90 (3")	55
ix)	110 (4")	80

6.4 Resistance of Valve and Valve Material to Internal Hydrostatic Pressure

The resistance of the valve and valve material to internal hydrostatic pressure shall be tested in accordance with Annex D and shall comply with its requirements.

6.5 Seat and Stem Sealing Test

6.5.1 *Seat Test*

Connect the valve inlet to a water supply pipeline and leave the valve outlet open to the atmosphere. Using the test conditions according to Table 9, close the obturator by means of the specified test torque and apply the specified water pressure for the specified duration. Perform the test for both sets of test conditions.

The test specimen complies with the test requirements if there is no leakage through the valve seat. If, during the test time, leakage appears through the valve seat, the sealing may be tightened once again by applying a test torque in accordance with Table 9. The test shall not cause permanent deformation in any part of the valve.

6.5.2 *Stem Sealing Test*

Connect the valve inlet to a water supply line with the obturator open and the valve outlet closed. Apply a water pressure of 1.5 times the nominal pressure for a duration of 1 h. Open and close the obturator alternately three times (that is, six movements).

Care shall be taken to ensure that the pressure during the closing phase does not exceed the test pressure specified above.

The test specimen complies with the test requirements if no leakage occurs through the packing. If, during the test time, leakage appears through the packing, the packing may be tightened once again by means of the packing nut. The test shall not cause permanent deformation in any part of the valve. If the valve stem sealing consists of an O-ring, repeat the tightness test at a pressure of 20 kPa (0.2 bar).

Compliance requirements are as specified above.

6.6 Valve Performance at Increased Hydraulic Pressure

Connect the valve to a hydraulic pressure supply line in which a flow meter is installed. Check that the upstream hydraulic pressure (at flow) is 1.5 times the nominal pressure and that the valve outlet is open to the atmosphere. Adjust the valve to maintain a flow velocity of 0.1 m/s in a pipe of nominal diameter equal to that of the inlet port. Maintain the pressure and flow velocity for 30 seconds.

The closing mechanism at the nominal pressure shall operate satisfactorily, the sealing parts shall not get displaced, and no vibration noise shall be detected.

6.7 Endurance Testing

6.7.1 *General*

This testing shall be performed as per Annex E but with the additions of **6.7.2** and **6.7.3** below.

6.7.2 *Initial Leakage Test*

With the valve closed, apply a hydraulic pressure at the valve inlet equal to the nominal pressure for 1 min. The valve outlet shall be open to the atmosphere. There shall be no visually detectable leakage.

6.7.3 *Test Procedure*

The valve shall be left open for 10 seconds. The flow velocity shall not exceed 1.5 m/s.

After closing the valve, apply an internal hydrostatic pressure equal to the nominal pressure. Maintain this pressure for:

a) 5 s in valves of up to 32 mm (1").
b) 10 s in valves of 40 mm (1 ¼ ") and above.

The number of test cycles performed shall total 5 000, of which 2 500 cycles shall be performed with water at 45 °C, and 2 500 cycles at ambient temperature. During opening and closing, there shall be no visually detectable leakage at the seal. After completion of these cycles, repeat the tests according to **6.5.1** and **6.5.2**. There shall be no visually detectable leakage.

7 MARKING AND PACKING

7.1 Each manually operated plastics valve that meets the requirements of this Standard shall bear a readily visible, clear and durable marking, which shall give the particulars listed under (a), (b), (e), (g) and (h) below. Particulars listed under (c), (d) and (f) shall be given on an attached label or on the packaging.

a) Name of manufacturer or registered trademark, if any;
b) Nominal size of inlet and outlet ports: for direct slip-on type connections to plastics pipe, the outside nominal diameter of the connecting pipe shall be given in millimetres; for threaded connections, the nominal thread size shall be given in accordance with IS 554;
c) Nominal pressure, in hundreds of kilopascals (equivalent in kg/cm^2);

d) Type of valve material: PE, PVC, PP, NP, etc.;

e) Direction of flow, if required, which should be shown on the valve body;

f) K_v Value of the valve;

g) Batch Number or Traceability code; and

h) Type of Valve along with Pressure rating as per **5.12.1** and **5.12.2.**

For Example: 2" Valve: PVC DN 50 TYPE- B CLASS – 2.

7.2 BIS Certification Marking

Each valve may also be marked with the Standard Mark.

7.2.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

Table 9 Test Conditions

(*Clause* 9)

Sl No. (1)	**Test Temperature** (°C) (2)	**Test Torque** (Nm) (3)	**Test Conditions** (4) Pressure (MPa)	 Duration (h)
i)	27 ± 3	1.2 × closing torque*	1.5 × PN	1
		1.5 × closing torque*	1.5 × PN	100

---

* *see* Table 8

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No./Other Publications	*Title*
IS 554 : 1999/ISO 7-1 : 1994	Pipe threads where pressure-tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
2500 (Part 1) : 2000/ISO 2859-1 : 1999	Sampling procedures for inspection by attributes: Part 1 Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (*third revision*)
IS 2643 : 2005/ ISO 228-1 : 2000	Pipe threads where pressure-tight joints are not made on the threads — Dimensions, tolerances and designation (*third revision*)
IS 3400	Methods of test for vulcanized rubber:
(Part 2) : 2014/ISO 48-2 : 2018	Rubber, vulcanized or thermoplastic — Determination of hardness (Hardness between 10 IRHD and 100 IRHD) (*fourth revision*):
(Part 4) : 2012/ISO 188 : 2011	Accelerated ageing and heat resistance (*third revision*)
(Part 10/Sec 1): 2020/ISO 815-1 : 2019	Compression set, Section 1 At ambient or elevated temperatures (*second revision*)
IS 4905 : 2015	Random sampling and randomization procedures (*first revision*)
IS 4984 : 2016	Polyethylene pipes for water supply — Specification (*fifth revision*)
IS 4985 : 2021	Unplasticized PVC pipes for potable water supplies — Specification (*fourth revision*)
IS 7834 (Part 1) : 1987	Injection moulded PVC socket fittings with solvent cement joints for water supplies: Part 1 General Requirements
IS 8008 (Part 6) : 2003	Injection moulded/machined high density polyethylene (HDPE) fittings for potable water supplies — Specification: Part 6 Specific requirements for pipe ends (*first revision*)
IS 10910 :1984	Specification for polypropylene and its copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
IS 10951 : 2020	Specification for polypropylene (pp) materials for moulding and extrusion (*second revision*)
IS 12235 (Part 1 to 19) : 2004	Thermoplastics pipes and fittings — Methods of Test
IS 13360	Plastics Methods of Testing:
(Part 3/Sec 10) : 2021/ ISO 1183-1 : 2019	Physical and dimensional properties, Section 10 Determination of density of non-cellular plastics immersion method liquid pyknometer method and titration method (*first revision*):
(Part 4/Sec 1) : 2000/ISO 1133 : 1997	Rheological properties, Section 1 Determination of the melt mass - flow rate (MFR) and the melt volume - flow rate (MVR) of thermoplastics (*first revision*)
IS 15801 : 2008	Polypropylene — Random copolymer pipes for hot and cold water supplies — Specification
IS 15927	Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Specification:
(Part 1) : 2012	Fittings for socket fusion using heated tools:
(Part 2) : 2012	Spigot fittings for butt fusion for socket fusion using heated tools and for use with electro fusion fittings
IS 16621 : 2017	Positive list of constituents of polyethylene and polypropylene in contact with foodstuffs pharmaceuticals and drinking water

IS No./Other Publications	*Title*
IS 16738 : 2018	Positive list of constituents for polypropylene polyethylene and their copolymers for its safe use in contact with foodstuffs and pharmaceuticals
IS 17425 : 2020	Irrigation Equipment — Quick coupled polyethylene pipes and fittings for sprinkler irrigation systems — Specification

ANNEX B

(*Clause* 5.2.2)

DETERMINATION OF TOLUENE EXTRACT OF CARBON BLACK

B-1 APPARATUS

B-1.1 Extraction Thimbles, double thickness, fat extracted**.**

B-1.2 Soxhlet Apparatus

B-1.3 Shallow Weighing Dish, 50 ml capacity, of borosilicate glass**.**

B-2 REAGENT

B-2.1 Toluene, Sulphur-free, of AR quality**.**

B-3 PROCEDURE

B-3.1 Place 5 g to 8 g of pelletized carbon black or 2 g to 5 g of compressed fluffy black in a paper extraction thimble. Insert the thimble into the soxhlet extractor. Measure 50 ml to 60 ml of toluene into the soxhlet flask.

B-3.2 Assemble the soxhlet apparatus and extract for 22 hours.

B-3.3 Evaporate successive small portions of the extract solution (filtered, if necessary) nearly to dryness in the previously cleaned, dried and tared 50 ml shallow glass weighing dish. Rinse the extraction flask with toluene and add the washings to the weighing dish. Evaporate the combined extracts on a hot plate to a volume of approximately 5 to 10 ml and finally the dish and contents in an oven at 115 °C, until dry.

B-3.4 Cool in a desiccator to room temperature and weight.

B-4 CALCULATION

B-4.1 Calculate the toluene extract; percent as follows:

Toluene Extract =

$$\frac{Mass\ of\ Extract}{Mass\ of\ Sample} \times 100\ percent$$

ANNEX C

(*Clauses* 5.2.2 *and* 5.2.3.5)

DETERMINATION OF MAXIMUM VOLATILE MATTER IN CARBON BLACK

C-1 APPARATUS

C-1.1 Electric Furnace

Capable of temperature regulation of ± 25 °C at 950 °C and equipped with a thermocouple-activated indicating pyrometer.

C-1.2 Platinum Crucibles, 25 mm × 35 mm

C-1.3 Petri Dish, 75 mm diameter

C-1.4 Oven, electrically operated air-circulating type, capable of temperature regulation of ± 1 °C at 100 °C.

C-1.5 Analytical Balance, having a sensitivity of 0.1 mg.

C-1.6 Desiccators

C-2 PROCEDURE

C-2.1 Dry 5 g of the sample in an air-oven at 100 °C for 2 hours.

C-2.2 Ignite two platinum crucibles in the electric furnace at 950 °C ± 25 °C for about 30 minutes. Cool to about 200 °C in an iron plate and place in the desiccators. When these attain the room temperature, weigh them to the nearest 0.1 mg.

C-2.3 Place 1 g of dried carbon black in the weighed crucible leaving an air space not more than 2 mm.

C-2.4 Ignite the crucibles and contents in the electric furnace for exactly 7 minutes at a temperature of 950 °C ± 20 °C.

C-2.5 Remove the crucible assembly to the desiccators, allow to cool to room temperature and weigh to the nearest 0.1 mg.

C-3 CALCULATION

C-3.1 Calculate the percentage of volatile matter as follows:

Volatile Matter =

$$\frac{Loss\ of\ Mass}{Mass\ of\ Sample\ taken} \times 100\ percent$$

NOTE — The loss of volatile matter during drying operation is negligible.

ANNEX D

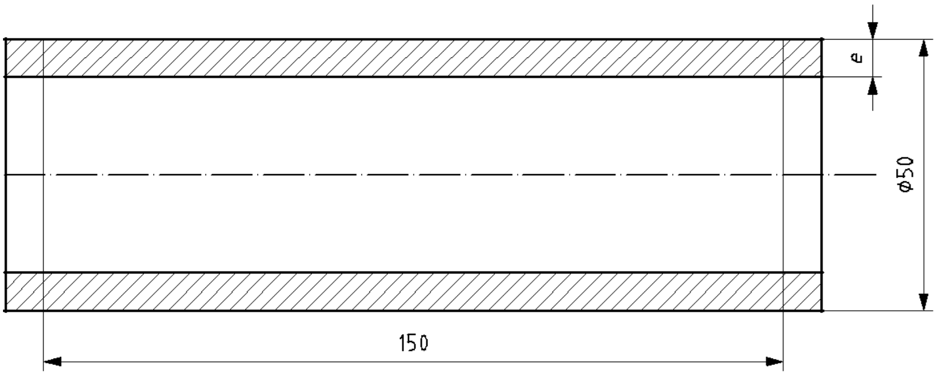
(*Clause* 6.4)

RESISTENCE OF VALVE AND VALVE MATERIAL TO HYDROSTSTIC PRESSURE

D-1 MOULDED PLASTICS MATERIAL OF VALVE BODY — PRESSURE TEST

This test may be omitted if the valve manufacturer supplies the test laboratory with a satisfactory test report on the strength requirements in accordance with Table 10. The pressure test shall be performed on an injection-moulded tube specimen made of the same material as the valve body. The dimensions of the specimen shall be as shown in Fig. 2.

The specimen shall be tested in accordance as per IS 12235 (Part 8 /Sec 1) and shall meet the strength requirements specified in Table 10. The specimen tested shall not suffer fracture or other damage.



Dimensions in millimeters

FIG. 2 FREE TEST LENGTH

Table 10 Test Conditions and Requirements for Pressure Test

(*Clause* D-1)

Sl No.	Material	Temperature (°C)	Circumferential Stress (σ_i) (N/mm^2)	Minimum Duration (h)
(1)	(2)	(3)	(4)	(5)
i)	PE 63	80	3.5 (3.2)	165 (1 000)
ii)	PE 80	80	4.5 (4.0)	165 (1 000)
iii)	PE 100	80	5.4 (5.0)	165 (1 000)
iv)	PVC U	60	10	1 000
v)	PP	95	3.5	1 000

$$\rho = \frac{2\,\sigma\,e}{d - e}$$

where

ρ = test pressure, in MPa;
σ = induced stress, in MPa;
e = minimum wall thickness, in mm; and
d = outside Diameter of Pipe, in mm.

D-2 SHELL TEST

The test specimen shall be considered satisfactory if no rupture or other visible failure occurs during the test period. The test specimen shall be regarded as unsatisfactory if the valve body bursts before the end of the test period. If a pipe or a connection fails, the test shall be considered null and void and shall be repeated on a different specimen.

Test conditions, which shall be according to Table 11, and the following:

a) tests under both sets of test conditions, that is. for durations of 1 hour and 1 000 hours, shall be performed for each material (*see* Table 11);
b) two sets of tests shall be carried out, each performed on a different valve shell; and
c) during the test period, the closing mechanism shall be open.

The test specimen complies with the test requirements if there is no evidence of leakage from the valve shell and no fracture or other failure occurs during the test period. The test specimen is considered as having failed if the valve shell bursts or the joints show signs of leakage before the end of the minimum test period. Packing leakage during the test shall not be cause for rejection.

Table 11 Test Conditions for Shell Test

(*Clause* D-2)

Sl No. (1)	**Material**[1] (2)	**Duration** (h) (3)	**Temperature** (°C) (4)	**Pressure** (MPa) (5)
i)	PE 63	1	27	4.2 × PN
		1 000	27	3.2 × PN
ii)	PE 80	1	27	4.2 × PN
		1 000	27	3.2 × PN
iii)	PE 100	1	27	4.2 × PN
		1 000	27	3.2 × PN
iv)	PVC –U	1	27	4.19 × PN
		1 000	27	2.2 × PN – dn < 90 2.74 × PN – dn ≥ 90
v)	PP	1	27	2.4 × PN
		1 000	27	1.5 × PN

---

[1] Test conditions for plastics materials other than those specified in Table 11 are under study and shall be added later.

ANNEX E

(*Clause* 6.7)

THERMOPLASTICS VALVES — FATIGUE STRENGTH — TEST METHOD

E-1 ENDURANCE TEST

The endurance test, using water as the fluid medium, at the temperature, pressure and velocity shall be carried out, as follows. Maintain internal pressure equal to Nominal Test Pressure throughout the test.

E-1.1 Open multiple-turn valves to the fully open position at a hand-wheel speed of 40 r/min ± 10 r/min for valves of nominal size up to DN 50 and 20 r/min ± 10 r/min for valves of nominal size greater than DN 50. For quarter-turn valves, the opening time shall be not less than 2 seconds, for valves of nominal size up to DN 50 and not less than 4 seconds, for valves of nominal size greater than DN 50. The valve shall be left in the open position for at least 5 seconds, but not longer than 20 seconds.

E-1.1.2 Close multiple-turn valves at a hand-wheel speed of 40 r/min ± 10 r/min. For quarter-turn valves, the closing time shall be not less than 1 second.

E-1.1.3 Closing shall be performed using the torque specified in Table 8. During opening and closing, there shall be no visible leakage at any seal.

E-1.1.4 After the valve has been closed with torque as specified in Table 8. The valve shall be left in the closed position for at least 5 seconds, but no longer than 20 seconds.

E-1.1.5 The valve shall be opened as described in **E-1.1.**

E-1.1.6 The test procedure described in **E-1.1** to **E-1.1.5** shall be repeated for 5 000 cycles on Electro-mechanical device capable of performing the cyclic test.

E-2 The complete valve shall be endurance-tested for opening and closing, under the following conditions:

a) The test fluid shall be water at PMA and 15 °C to 30 °C at the upstream side of the valve;
b) With the valve fully open, establish a flow of water at a velocity of (1± 0.2) m/s;
c) Then fully close the valve, the pressure downstream shall be atmospheric;
d) Then fully open the valve as specified in b) above; and
e) Then repeat until a minimum of 5 000 cycles.

E-2.1 After the endurance test carried out in accordance with **E-2**, the following requirements shall apply:

The shell tightness shall be in accordance with the requirements as follows:

a) The test specimen shall be considered satisfactory if no leakage from the valve is noted, and no rupture or other visible failure occurs during the test period. The test specimen shall be regarded as unsatisfactory if the valve body bursts before the end of the test period;
b) If a pipe or a connection fails, the test shall be considered null and void and shall be repeated using a different specimen; and
c) All functional parts shall be serviceable after endurance testing.

ANNEX F

(*Foreword*)

COMMITTEE COMPOSITION

Farm Irrigation and Drainage Systems, FAD 17

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Panel to Formulate Standards on By-Pass Assembly, Control Valve, Flush Valve & Throttle Valve
FAD 17/P-7

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Amend No.	Date of Issue	Text Affected

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